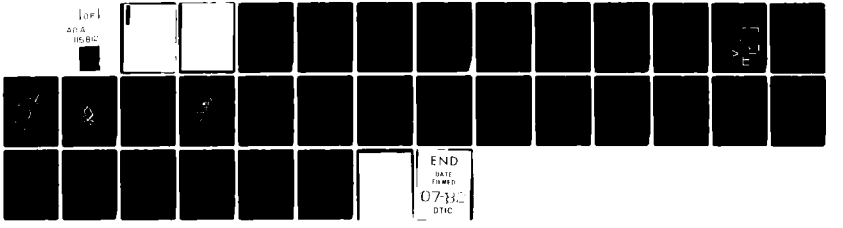
AD-A115 812 SYNECTICS CORP ROME NY F/G 14/3
ADVANCED CARTOGRAPHIC DATA DIGITIZING SYSTEM.(U)
APR 82 P D BELL, D A KOLASSA, J A TERENZETTI F30602-79-C-0261
UNCLASSIFIED RADC-TR-82-102 NL



UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER RADC-TR-82-102	2. GOVT ACCESSION NO. AD-A115 812	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ADVANCED CARTOGRAPHIC DATA DIGITIZING SYSTEM		5. TYPE OF REPORT & PERIOD COVERED Final Technical Report 1 Oct 79 - 28 Feb 82
		6. PERFORMING ORG. REPORT NUMBER N/A
7. AUTHOR(s) Paul D. Bell David A. Kolassa Joan A. Terenzetti		8. CONTRACT OR GRANT NUMBER(s) F30602-79-C-0261
9. PERFORMING ORGANIZATION NAME AND ADDRESS Synectics Corporation 310 East Chestnut Street Rome NY 13440		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 64701B 43030338
11. CONTROLLING OFFICE NAME AND ADDRESS Rome Air Development Center (IRRP) Griffiss AFB NY 13441		12. REPORT DATE April 1982
		13. NUMBER OF PAGES 40
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Same		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Same

18. SUPPLEMENTARY NOTES

RADC Project Engineer: Terence Hallinan (IRRP)

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Cartographic Data Digitizing	Computers
Lineal Digitizing	Automation
Point Digitizing	Bathymetric Data

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the Advanced Cartographic Data Digitizing system functional capabilities as a complete digital cartographic system. Topics from data digitizing through product generation including overall system description, hardware configuration, host processor software and workstation software are covered. In addition, the report describes avenues of system expansion if these are deemed appropriate by the Defense Mapping Agency.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

List of Illustrations

SECTION 1. INTRODUCTION

1.1 General

This report is the Final Technical Report for the Advanced Cartographic Data Digitizing System (ACDDS). The information herein is in fulfillment of the obligation set forth in Contract No. F30602-79-C-0261 and was prepared in accordance with MIL-STD-847A and DI-S-3591A/M. Companion documents which provide additional, very detailed technical information are:

1. Final Design Plan for ACDDS
   May 1980

2. ACDDS Program Maintenance Manual (Volume I and II)
   November 1981

3. ACDDS Computer Operator Manual
   August 1981

4. ACDDS Computer Program Test Plan
   June 1981

5. ACDDS Computer Program Test Procedures
   July 1981

6. ACDDS Test Analysis Report
   February 1982

7. Training Course Outline for ACDDS
   July 1981

8. ACDDS System Integration Plan
   December 1979

9. ACDDS Program Schedule
   December 1979

10. ACDDS Computer Program Development Plan
    December 1979

11. Reliability and Maintainability on Commercial Equipment for ACDDS
    July 1981

12. ACDDS Orthorectification Functional Design Report
    February 1982

1.2 Background

Rome Air Development Center (RADC) has been firmly established in the development of digital cartography for a number of years. This involvement spans a wide variety of technologies including manual lineal digitizing, sounding value entry via voice input terminal and others such as raster data processing.

In the area of lineal digitization modern technological efforts such as the Lineal Input System (LIS), Bathymetric Data Reduction System (BDRS) and the Italian Air Force Geographical Data Processing System (IAF/GDPS) efforts concentrate on the ability of the cartographer to select and collect only that lineal information which requires conversion to digital form. These systems support the digitization process which includes, chart parameter control information input (initialization), chart registration, feature header identification, digitization modes (lineal trace, depth and discrete point entry), review mode (review of collected information), edit mode, auxiliary mode and remote job entry mode (submission of batch processing). The batch processing includes projection transformation, sectioning, paneling, plotting (proof and symbolization plotting), magnetic tape input/output, filtering, sort/merge, format conversion, batch reporting and system utilities.

In the area of depth sounding value entry, RADC has sponsored a variety of projects to assist in the collection of sounding data via voice terminal entry, one of which was the Bathymetric Data Reduction System (BDRS). In this area, the digitizing station operator need only speak the depth sounding value or a change value, to enter the depth into the digitizing system. Upon operator voice command, the Cartesian coordinate (X-Y) and depth value are entered into the digitizing system.

1.3 Scope

The scope of the ACDDS effort included all activities required to specify, design, fabricate, procure, integrate, and test a hardware and software system which met the functional requirements defined in the Statement of Work. The scope also included the efficient optimization for operator controlled activities as well as data processing efficiencies.

The ACDDS was designed to be a replacement system for the LIS, therefore, the ACDDS will be required to support the products currently being generated on the LIS. These major products are:

1. AWACS Digital Land Mass Blanking (DLMB) data base.

2. Radar Trainer data bases.

3. Standard Nautical Chart Compilation and Production.

SECTION 2. SYSTEM OVERVIEW

The following paragraphs provide a brief look at the entire system and its operations. More detailed information concerning these topics can be found in the Design Plan, Programmers Maintenance Manual (Volumes I and II), and the Test Analysis Report.

2.1 Subsystem Concept

The Advanced Cartographic Data Digitizing System is based upon a subsystem concept. This allows for the efficient utilization of both human and machine resources. One subsystem supports data acquisition while the second primarily performs operations on the data. The following discussion defines the roles of each subsystem and the data flow throughout the entire system.

2.2 Workstation Subsystem Role

The system design allocated two primary functions to the Workstation Subsystem. Namely, the conversion of analog data to a digital format and submission of batch task requests to the host processor. In general, the satellite workstations capture data and pertinent information, building a data file to which host processing can be applied. Transporting the data file to the host may be accomplished in one of two ways. An operator may physically carry the removable disk from the workstation to the host. A more convenient method is to send the file over a dedicated synchronous line. This second method is also the means by which batch processing tasks are submitted to the host processor.

2.3 Host Subsystem Role

The host subsystem is designed for two primary processes. The first function is to interface with the satellite workstations and other systems such as the BDRS and LIS. The link between the host and workstations is provided by a set of synchronous communication lines, one for each workstation. Data files and batch task requests may be submitted through this connection. Other systems are able to interface directly with the ACDDS via magnetic tape. However, the most important function for the host subsystem is to perform batch processing tasks as directed. The software

modules reside on the host processor which is capable of processing multiple tasks simultaneously. Each task is checkpointable from the host master console to accommodate shift changes and may be resumed at a later time.

2.4 Data Flow Description

Data is first captured by the workstation subsystem. Analog data is correctly converted to digital via the workstation peripheral devices (keyboard, digitizing table, alphanumeric and graphic CRTs). After the digital data is stored to disk it may be updated and corrected interactively via the editing capability. Once the file has been completed it may be sent to and stored on the host subsystem for manipulation by batch processes. This is accomplished via the communication lines or the physical interaction between operator and system in moving the disk.

Information transmitted to the host via the communications line is intercepted by the host's communications front end process. Here the information is directed to one of the mass storage devices for further processing. This procedure also activates the batch executive for execution of the required process. The output of the requested tasks is then returned to mass storage within the host subsystem. This flow is graphically depicted in Figure 2-1.

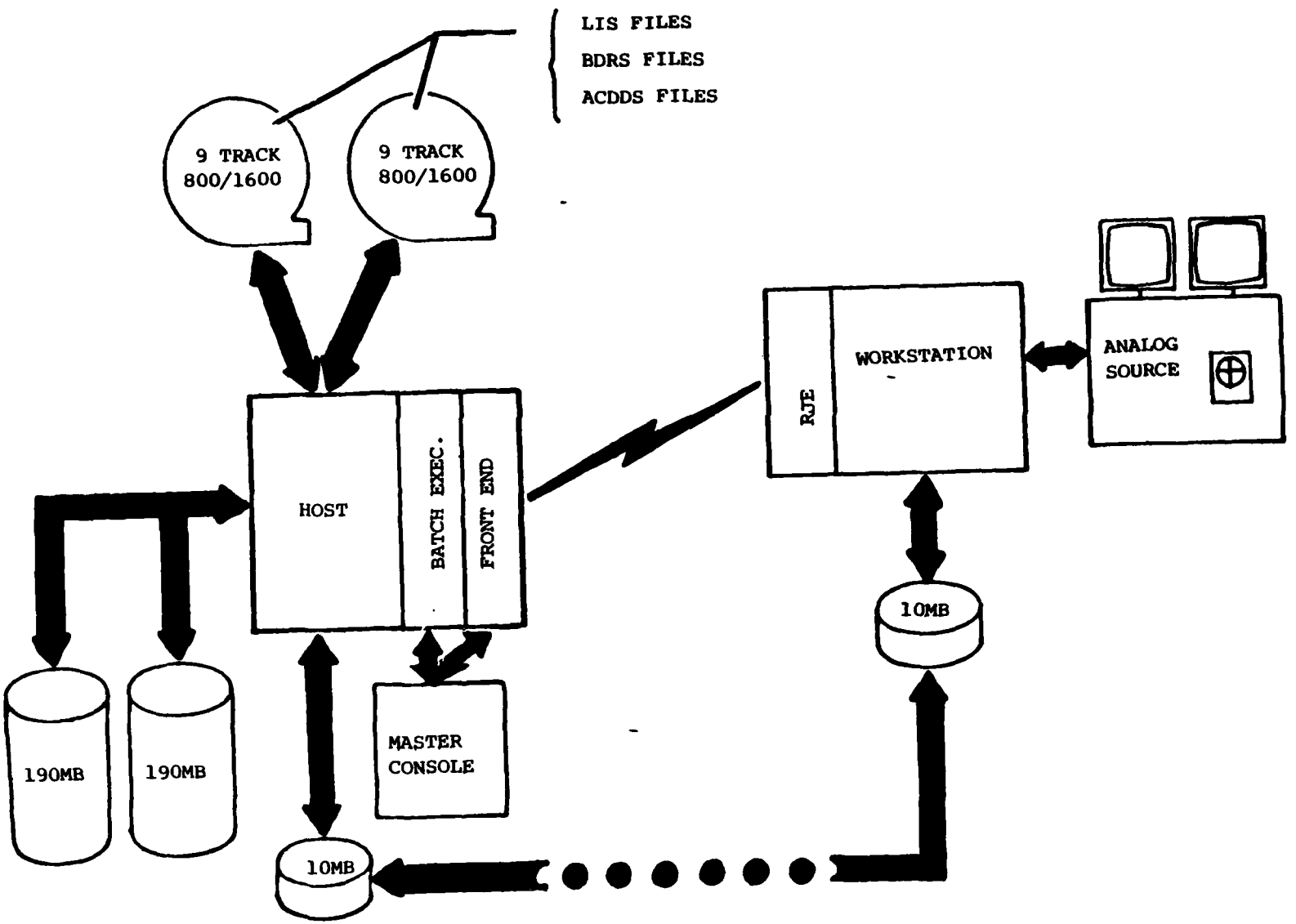


Figure 2-1. ACDDS Data Flow

SECTION 3. HARDWARE OVERVIEW

3.1 ACDDS Subsystem Configuration Concept

The ACDDS has been configured as two separate subsystems; Workstation and Host.

The system is an architecture of three satellite workstations linked to a host processor. The three separate workstations give the Host Processor freedom to handle many activities simultaneously. An artists' conception of the overall ACDDS hardware configuration is depicted in Figure 3-1.

3.2 Workstation Subsystem

The following information pertains to the hardware configuration of the three workstations (Digitizing Systems). A roster delineating the hardware illustrated in Figure 3-2 is presented.

The ACDDS hardware for these three stations includes the following components:

1. Data General NOVA 4/S Computer with 32K, 16-bit words of memory; (3)
2. 10MB Disk (5MB fixed - 5MB removable); (3)
3. Data General 6052 Video Display Terminal; (3)
4. Universal Line Multiplexor (ULM-5); (6)
5. Threshold Technology 500 Voice Terminal; (1)
6. ALTEK Corporation DATATAB back lite digitizers; (3)
7. Tektronix GMA 102A 19" Graphic CRT; (3)
8. Standard ACDDS Digitizing Cursor; and
9. Tektronix Hardcopy Unit.

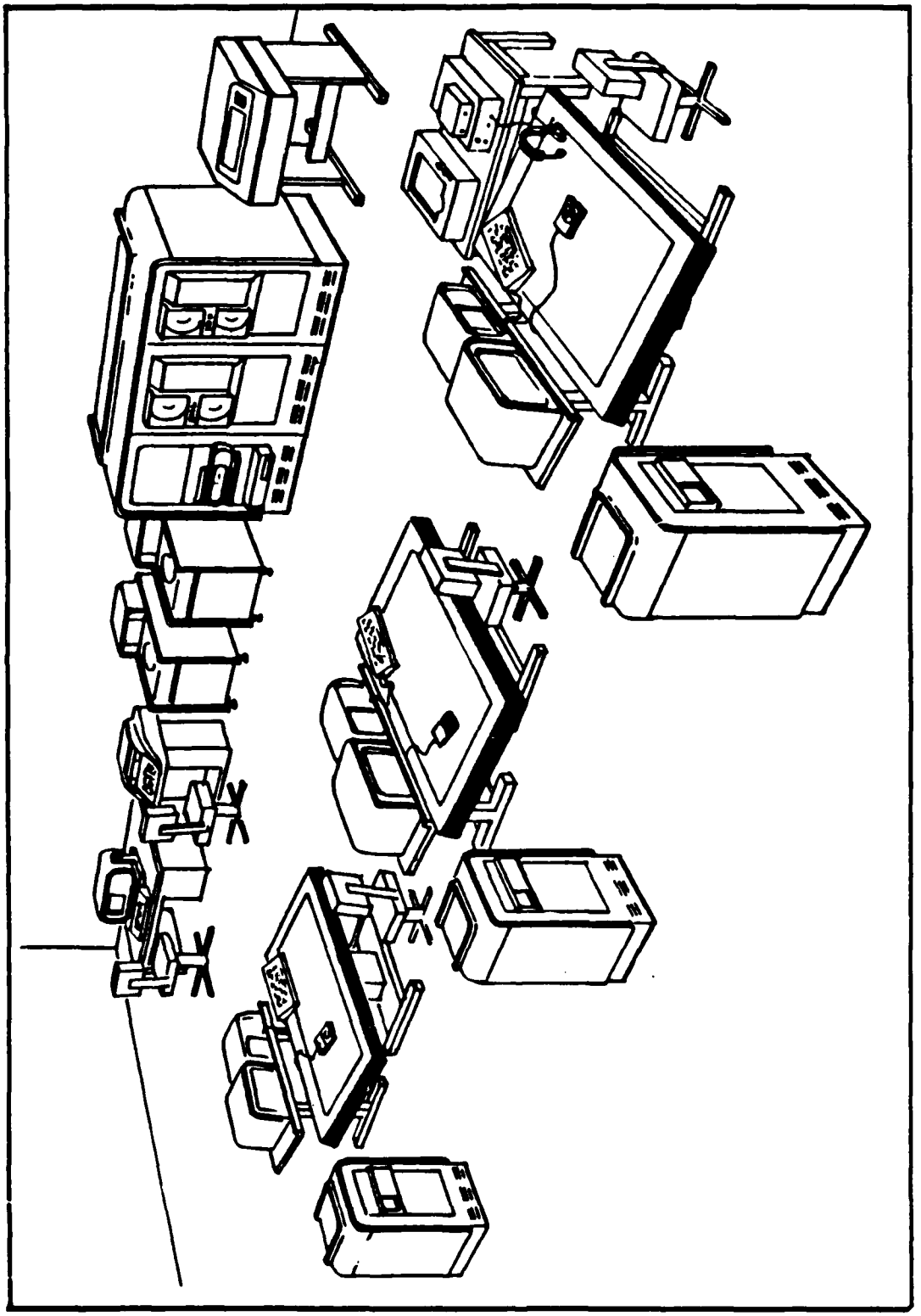


Figure 3-1. ACDDS Hardware Configuration

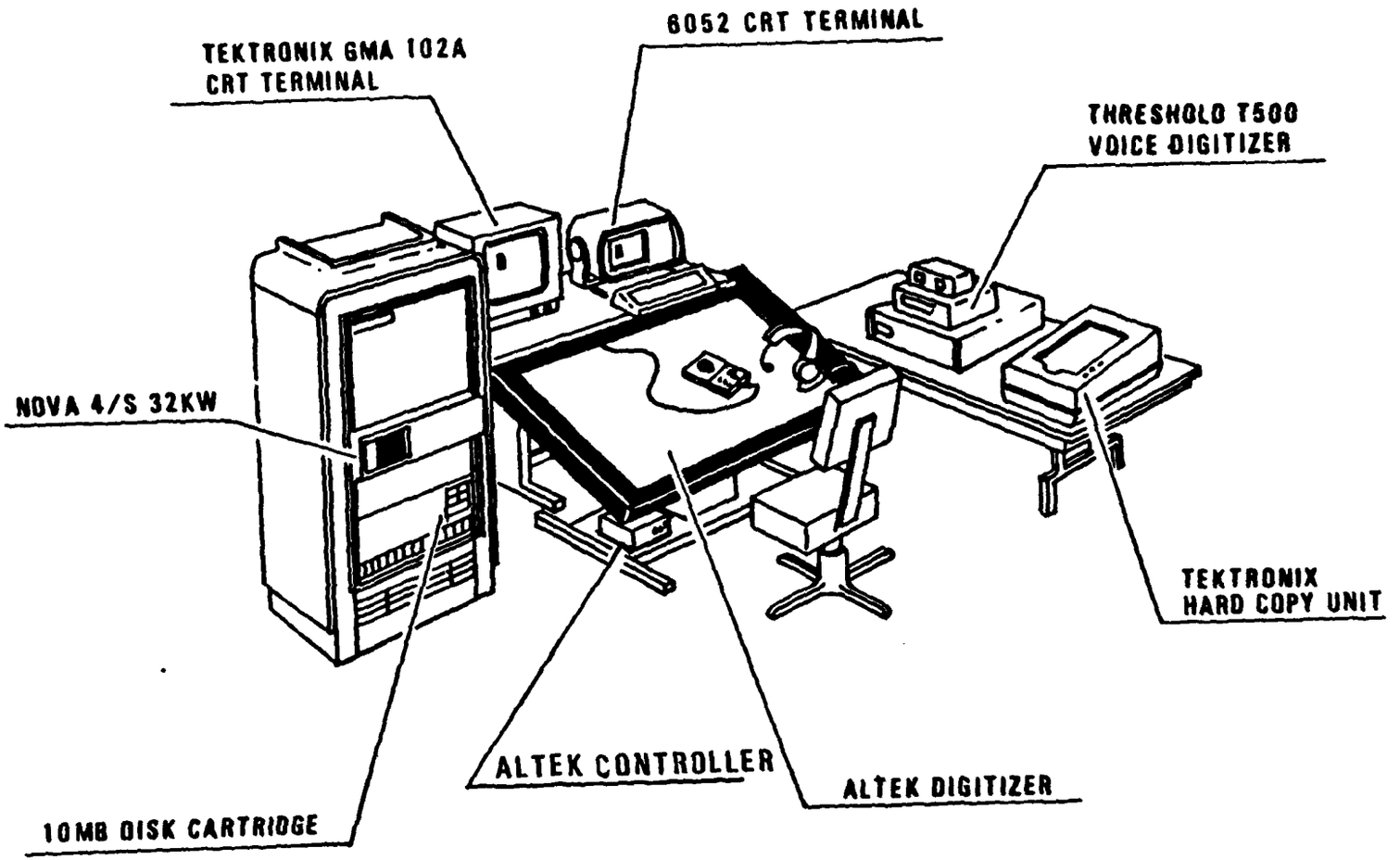


Figure 3-2, ACDDS Satellite Station

3.3 Host Subsystem

The ACDDS Host Processor hardware configuration (reference Figure 3-3) consists of the following:

1. Data General ECLIPSE S/130 computer with 512K of MOS memory (16 bit word);
2. Floating Point Instruction Set;
3. I/O Expansion Chassis which adds 12 I/O slots;
4. 60 CPS Terminal Printer;
5. Data General 6052 Video Display Terminal;
6. Magnetic Tape Units (two 800/1600 BPI, 75 IPS, 9 Track);
7. 190MB Disk Unit - two;
8. 10MB Disk Unit - one; and
9. Data General 300 LPM Printer.

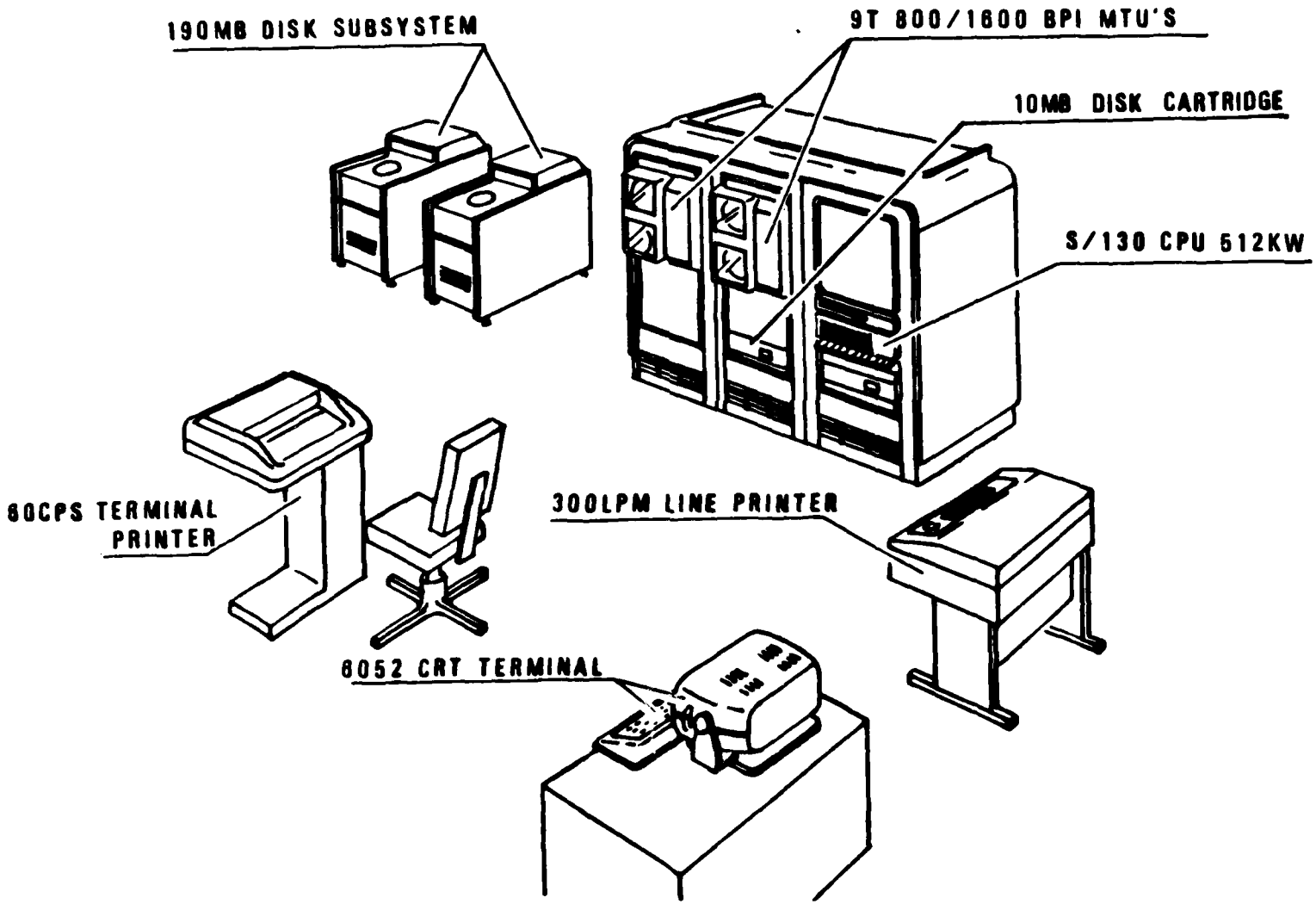


Figure 3-3. ACDDS Host Processor Hardware Configuration

SECTION 4. FUNCTIONAL OVERVIEW

4.1 ACDDS Workstation Functions

The digitizing functions are conducted on the ACDDS in an interactive environment. Sign-on/Initialization and Registration modes are the first functions performed in an ACDDS job session. Depending on whether a new job is to be created or an existing job is to be updated, these functions allow for parameters to be entered or edited and for registration or reregistration to occur.

The Executive Mode is the central mode of operation. From this function, several processing paths are open to the operator for lineal or point digitizing, review, and editing. The transfer of control from one mode of operation to another is performed using the pushbuttons on the digitizing cursor or the DG6Ø52 keyboard.

4.1.1 SIGN-ON FUNCTION

The Sign-On Function is the first function processed. It provides the user with easy access to each of the five modes of operation: session start/station initialization, remote job entry (RJE), send file to host, diagnostic function, or sign-off.

4.1.2 SESSION START/STATION INITIALIZATION

This function is used to prepare for a job session. Among the activities which are performed under this function are entry of: operator I.D.; job identification; mode of operation (experienced/inexperienced); and parameter control information.

If it is a new job, all appropriate files are created/opened and initialized for processing feature table data file, grid feature index file, feature identification file, and working header. If an old job is being reopened for further processing, the parameter control input is bypassed. The next step performed within this function is the initialization of the voice entry terminal (if voice station). This is accomplished by the user entering a speaker number followed by training or re-training directives. Once this is accomplished, process control returns to the executive function.

4.1.3 REGISTRATION FUNCTION

After the completion of the session start/station initialization function, or the selection of registration within the auxiliary mode, the executive will load the registration function into memory and invoke its execution. The purpose of the registration function is to produce a correlation between what is read from the table and the actual position on the earth's surface. This function is flexible enough to allow the document to be removed from the digitizing/editing table and replaced when digitizing/editing is resumed. The registration function calculates equations which aid in correlating the chart to its actual position on the earth. The original points of reference, those first entered within this function, are stored in the master file. Re-registration invokes a general affine transformation algorithm which will correlate the new position with the original stored points of reference.

4.1.4 HEADER BUILD

The header build task is used to generate a set of cartographic header description codes that will be applied to digitized features. The header descriptors are selected by the operator utilizing the Defense Mapping Agency Standard Cartographic Feature Digital Identification catalog and its map/chart feature definitions and codes.

4.1.5 EXECUTIVE MODE

The executive mode is the process scheduler and controller of the ACDDS digitizing task. On operator command, the executive will load the appropriate functional application module into memory from disk and invoke its execution. Through this, the central mode of user operations, access is made to the Trace, Depth, Discrete Point, Review and Edit functions.

Additional capabilities available through Executive Mode are auxiliary mode, enter textual headers, change elevation values, header selection and close file.

4.1.6 TRACE MODE

The trace mode task accepts X, Y coordinate pairs derived from the digitizing table and packs these coordinate data strings into a feature data set. This mode also has the capability to close a feature giving the endpoint the same X,Y as the first X,Y, or to perform a type one edit (edit current feature). Exit to executive is provided.

4.1.7 DEPTH ENTRY MODE

The depth entry mode is used to digitize bathymetric depth sounding data. It utilizes the Threshold Model 500 voice data entry terminal, or DG6052 keyboard numerics for purposes of entering this data. This mode has the capability to delete the previous depth or to change a character size via pushbutton directives, or exit to executive mode.

4.1.8 DISCRETE POINT MODE

Discrete points mode is used to input single point feature information such as spot elevations, buoys, etc. Using the digitizing table cursor, points from the table are input/recorded as feature locations. As in depth entry, this mode also has the capability to delete the previous point. Exit to Executive is also provided.

4.1.9 REVIEW MODE

The review mode allows for the examination of all features (trace, depth, and the discrete points) collected within a job. The review mode displays features (graphic Tektronix CRT) in a rectangular window area, with the current digitizer cursor position defining the center of the display area. Additional capabilities of this function are options to change display scale, display a new window, stop feature and display crosshair, exit to executive.

4.1.10 AUXILIARY MODE

The function of the auxiliary mode is to change parameter information used in processing a job. These functions are as follows: display scale change, enter graphic remarks into the commentary record, return to header build, return to registration, alter contour elevation and interval, and switch from inexperienced to experienced or vice versa.

4.1.11 EDIT MODE

The edit mode is the task which allows the operator to select a digitized feature from the working data file and affect some change. The edit mode functions are as follows:

1. File Header Update;

2. Feature Header Update;

3. Locate Feature;

4. Locate Feature (Feature I.D.);

5. Locate Feature (Geographic Coordinate);

6. Feature Reorder;

7. Trace Data Edit (Segment/Join);

8. Point Data Edit;

9. Edit Utilities (Change Display Scale/Search Tolerance/ Search Mask/Review); and

10. Delete Feature.

4.1.12 HELP MODE

The help mode function is intended to explain to the station operator the method of using the selected operation. It explains what digitizing table cursor pushbuttons, keyboard input, etc., are to be used for that function.

4.1.13 REMOTE JOB ENTRY

The Remote Job Entry (RJE) function makes available to the workstation operator a means by which batch processing tasks may be submitted to the host processor. The batch tasks that are available from the station are as follows:

1. Tape Input;

2. Tape Output;

3. Sort;

4. Merge;

5. Format Conversion;

6. Unit Conversion;

7. Projection Transformation;

8. Sectioning;

9. Paneling;

10. Symbolization;

11. Plot;

12. Table File Update;

13. End of Job; and

14. Cancel Job.

4.1.14 SEND FILE TO HOST

This function is envoked from sign-on and allows the user to transmit a data file to the host processor. Upon successful completion the user will be returned to Sign-On.

4.1.15 WORKSTATION DIAGNOSTIC

The purpose of this function is to make available to the workstation operator a means of verifying that the workstation hardware is in operational order. This function is selected from the Sign-On mode. After it has been invoked, an option display is presented to the operator on the DG6Ø52 display. The operator then selects the peripheral diagnostic he/she will operate. On termination of this mode, process control is returned to the Sign-On Mode. The diagnostics that may be exercised are as follows:

1. Tektronix GMAlØ2A Diagnostic. This diagnostic program interacts with the DG6Ø52 keyboard and display, Tektronix's display, and the digitizing tables. It has the capability to display the table cursor track while in continuous mode.

2. Threshold Voice Entry Terminal Diagnostic. This program is also interactive. It will test the interface between the workstation processor and the Threshold Voice Entry Terminal microprocessor.

3. Digitizer Diagnostic. This diagnostic demonstrates the proper functioning of the interface between the Altek Digitizing Table and the NOVA 4 Processor.

4.2 Host Functions

The Host Processor is capable of processing multiple batch functions simultaneously. In the subsections that follow, each host processor function will be identified and briefly discussed.

4.2.1 TAPE INPUT

This function enables the transfer of geographic or table formatted feature files from magnetic tape to disk. A filter capability is included for ACDDS data files.

4.2.2 TAPE OUTPUT

The Tape Output function enables the transfer of geographic or table formatted feature files from disk to magnetic tape. The additional capability of merging two ACDDS disk files to form a single tape file is available.

4.2.3 SORT

The Sort program reads an input disk file, filters the data, writes the accepted data on one output disk file, and if requested, writes the residual data on the second output disk file. This program accepts only a geographic or table ACDDS formatted data file. The output file(s) is of the same format as the input file.

4.2.4 MERGE

The Merge function combines two disk data feature files and writes the resultant data on a third disk file. The input files may be either table or geographic, as long as the two input files are the same coordinate type.

4.2.5 FORMAT CONVERSION

Batch functions allow data generated on the BDRS, LIS, and ACDDS to be converted to one of the other formats. Table data (X,Y - rectilinear data) can be converted to another table data format; Geographic data (ϕ,λ latitude, longitude, angular data) can be converted to another geographic format.

4.2.6 UNITS CONVERSION

Sounding data (depth value) are recorded in feet, meters, fathoms, or fathoms plus feet in the ACDDS system. The units conversion batch program changes the units in which the sounding depth data is stored in an ACDDS file.

4.2.7 PROJECTON TRANSFORMATIONS

The source data digitized on the ACDDS system is a projection of the angular geographic data onto a planar, conic, or cylindrical geometric surface. Projection transformations are batch functions which provide the mathematics to convert the geometric projection to geographic coordinates and the geographic coordinates to geometric projections. Datum shifts from one ellipsoidal earth model to another are included. The projections and inverse projections of the ACDDS are Mercator, Transverse Mercator, Lambert Conformal (two standard parallels) Polyconic, Polar Stereographic, Albers Equal Area Conic, and Gnomonic.

4.2.8 SECTIONING

This function provides the capability to segment a geographic or table feature data formatted file. The table formatted file is based on a specified area boundary of three to eight vector points entered at the digitizing table. The geographic data formatted file is based on a specified rectangular area boundary of min/max lat/lon values entered during the RJE request.

4.2.9 PANELING

This function butt-joins two feature files which share a common boundary and creates a single disk resident file from the two input disk resident files. The paneling process joins smoothly the ends of the common feature from the two table or geographic data files which share a common border. This ensures that no overlaps or gaps exists.

4.2.10 SYMBOLIZATION

This batch function to symbolize a file accepts as input a table file and outputs an intermediate plot command file with lineal and point features symbolized for plotting according to Chart No. 1 symbology specifications. Alphanumeric annotations which accompany the symbols are included along with four (4) pen codes for plotting in symbolized multicolor form.

4.2.11 PLOT

This function produces a high-quality, geodetically accurate proof plot or a symbolic plot from the output file of the Proof Plot or Symbolization program, respectively. When this task is initiated, the Xynetics or Calcomp plotting system may be selected as the output device.

4.2.12 TABLE FILE UPDATE

This function allows the user the option of returning an ACDDS data file that has been altered/created by one or more of the host processor's functions back to the digitizing table. By generating a grid feature index file, feature identification file and a working header file, an ACDDS table data file may be put back on the digitizing table for additions and modifications.

4.2.13 CHECKPOINT

The checkpoint function allows the operator to stop a process in the middle of the execution. All necessary data for restarting the job is stored on disk, allowing the process to resume at a later date via the restart function. This function gives the ACDDS a shift change capability. The operator has the option of checkpointing a single job or all jobs executing.

4.2.14 RESTART

The restart function initiates the startup of a job which has been previously checkpointed. Jobs must be restarted one at a time by entering their path segment.

4.2.15 ACDDS FILE PRINT

This utility allows the user to obtain a readable print of an ACDDS data file. The operator may specify the type of data file print needed:

1. A summary of the parameter control information;
2. All the information in the parameter control blocks;
3. All the information in the parameter control blocks and all of the feature headers; or
4. The entire file.

4.2.16 FILTER FILE BUILD

In order to build an ACDDS filter file, the operator must invoke the filter file build utility. This will construct the file a page at a time. By using this utility, he/she may also edit a page of an existing filter file.

4.2.17 SYMBOLIZATION SPECIFICATION/OVERRIDE FILE BUILD

This utility provides the user the capability to create or override the specification files used by the symbolization function. The text editor, linedit, is the actual vehicle used in creating these files.

4.2.18 FILTER FILE PRINT

This utility allows the operator to get a hardcopy print of a disk resident ACDDS filter file.

4.2.19 SYMBOLIZATION SPECIFICATION/OVERRIDE FILE PRINT

The purpose of this utility is to provide the user a means whereby he/she may obtain a hardcopy of the specification file or a specification override file.

4.2.20 DATA ACQUISITION

One means of data transfer is for the user to take the 15 megabyte removable disk from a satellite workstation and place it in the host processor. The data is then transferred to the ACDDS data directory, :S:CARTO_DATA, via the Data Acquisition function.

4.2.21 HOST TO WORKSTATION DISK TRANSFER

This function allows the user to retrieve data from the host processor's data directory, :S:CARTO_DATA, and place it on a 15 megabyte removable disk. At this point, the disk can be taken to a workstation where the retrieved file may be edited.

4.2.22 EXIT

When this utility is invoked it brings down the ACDDS system. It should only be used when the operator intends to bring down the host processor.

SECTION 5. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions focus on the major characteristics and improved cartographic production procedures that the ACDDS implementation has brought about. This is followed by recommendations that could further exploit the potential of the ACDDS.

5.1 Conclusions

The ACDDS effort has demonstrated a successful implementation that combined advanced technology, hardware, communications, and programming techniques. Increased speed and efficiency of the digitizing process over previous procedures has been realized. The system offers more precision, and ease of use by relieving the operator of tedious tasks, Data manipulation functions have also experienced increased efficiency and capability.

Achievement of these characteristics was brought about by a system design organized around a subsystem concept. This design proved to be effective in maximizing the functions allocated between the host and workstation. Data capture is provided by the workstation while the host supplies the processing power. With this, the ACDDS has the capability to fully support and aid the cartographic production elements at the Defense Mapping Agency.

5.2 Recommendations

The recommendations to follow discuss enhancements/augmentations to the present system from both the hardware and software viewpoints. Of equal importance within the forthcoming discussion is the ACDDS utilization within the referenced Mapping Agency.

5.2.1 ENHANCEMENTS/AUGMENTATIONS

5.2.1.1 Host Hardware

1. Addition of a Data General Data Control Unit to increase communication line speed between the workstation and host processor.

2. The addition of an extended user microprogramming facility on the Host processor ECLIPSE S/130 could help decrease the processing time of compute bound functions. Constantly utilized computer bound algorithms could then be implemented in microcode which would increase throughput for those algorithms by a factor of three to ten times.

3. Replacement of the present Host processor (CPU only) with one that included a floating point hardware unit would decrease processing time for compute bound functions (i.e., transformations).

4. A substantial decrease in input/output time could be realized by the addition or inclusion of a Burst Multiplexor Channel (BMC) on a host processor that can support this option.

5. The addition of a second DG6Ø52 CRT to the Host processor would eliminate accidental termination of the ACDDS Front End and Batch Executive processes. Also, fewer privileges would be needed by the user to execute batch functions. This would insure greater system integrity.

6. Investigation and analysis of the impact of the Local Area Network on the ACDDS is recommended. In this study, both hardware and software requirements would be identified.

5.2.1.2 Workstation Hardware

1. Increasing the memory size of the workstation processor (Data General NOVA 4/S) from the present 32K word to 64K words would increase the processing speed by relieving the CPU from swapping, chaining and overlaying station software functions. It would also allow for future expansion of workstation functionality.

2. Augmenting one workstation to include a color CRT. This could be used to visually depict areas for operator tagging of features to edit as well as enhance the capabilities of the workstation in the feature edit and feature review functions.

3. To decrease/eliminate artificial light glare on the workstation graphic display (Tektronix GMA 102A) an optical shield should be mounted on the screen's surface.

5.2.1.3 Host Software

1. An investigation of other systems the ACDDS may data interface with is recommended. If warranted, these data interfaces (format conversion) could be implemented giving greater versatility to the present ACDDS. Possible data types to investigate are the new DMA standard format, the high resolution data base (visual data base), Digital Terrain Elevation Data (DTED), Digital Feature Analysis Data (DFAD), Digital Vertical Obstruction Data (DVOD) and the Sci-Tex System.

2. Multiple headers for the same feature segment could be implemented in the ACDDS data file. This would facilitate the interfacing with Digital Feature Analysis Data (DFAD).

3. Host to workstation communication software would make it possible to send a data file back to the workstation without physical disk transfer.

4. The incorporation of a smoothing function (line generalization) would increase the efficiency of data processing by serving as an error detector and eliminator. This could be performed either at the workstation during digitization or as a host function.

5. The present plot capability could be expanded to interface with other plotters (i.e., Gerber, CRT Print Head).

6. Addition of the ability to section on concave polygons (interior angles greater than 180°) would greatly expand the present sectioning capability.

7. The ability to panel on more than one common boundary would be a desirable addition to the system.

8. A catalog system (data library) of processed files could be created. From this library, density of coverage in a particular geographic area could be ascertained.

5.2.1.4 Workstation Software

1. The workstation Help function could be expanded to include a training mode which would guide inexperienced operators through a training session and supply experienced operators with a reference tool.

2. The capability to produce symbolized displays on the workstation graphic display (Tektronix GMA 102A) would be an advanced addition to the system.

3. The capability to define multiple headers to feature segments during the digitization function would enhance the ACDDS. It would also facilitate the interfacing with the Digital Analysis Data (DFAD).

4. Enhance the workstation communication function to retrieve lineal data files from the Host system.

5.2.2 UNIVERSAL LINEAL DIGITIZING SYSTEM FOR DMA

The ACDDS powerful system features are ideal for standardization of generating and maintaining lineal digital data. Equally so, are its flexible capabilities to generate data for all DMA production centers thus providing a universal lineal digitizing system. Some of the strong ACDDS demonstrated system features are presented in the paragraphs to follow:

5.2.2.1 Demonstrated System Features

1. DMA Standard Cartographic Feature Digital Identification: By utilizing the DMA Standard Cartographic Feature Catalog for the identification of features within the ACDDS, the exchange and understanding of cartographic information regardless of the originating center or original user if possible.

2. Integrity of Data: The highly accurate (accurate beyond the requirement) workstation and host processing methods utilized on the ACDDS impact virtually no accumulative loss of data precision; thus integrity of data is maintained.

3. Strong Workstation Digitizing and Editing Capabilities: With the digitizing and editing capabilities of the system, data can be captured/corrected in a quick and efficient manner due to the extremely effective man-machine interface procedures.

4. ACDDS Host and Workstation Throughput: Depicted in Figure 5-1 and 5-2 are the demonstrated throughput capabilities of the host and workstation, respectively. As presented, the workstation demonstrated capability went far beyond the required throughput.

5. Reliable ACDDS Hardware/Software: The ACDDS modular hardware/software system makes available a system that is extremely reliable. The functional characteristics (hardware and software) of the system makes for a steady state system.

FUNCTIONS EXECUTED:

- PROJECTION TRANSFORMATION
- UNIT CONVERSION
- FORMAT CONVERSION
- SYMBOLIZATION
- SECTION
- PANEL
- TAPE I/O
- PLOT
- MERGE
- SORT

	TIME	FILE SIZE	NUMBER OF FUNCTIONS *EXECUTING* SIMULTANEOUSLY
THROUGHPUT REQUIREMENTS	1 HOUR	2400 LINEAL INCHES	MINIMUM OF 2
DEMONSTRATED CAPABILITY	55.3 MINUTES	2410 LINEAL INCHES	4

Figure 5-1. ACDDS Host Throughput

FUNCTION	REQUIRED THROUGHPUT	DEMONSTRATED CAPABILITY	ACHIEVEMENT BEYOND REQUIREMENT
MANUAL LINEAL TRACE	100 INCHES/HOUR	491 INCHES/HOUR	391 INCHES/HOUR
COMPUTER-ASSISTED POINT ENTRY	500 POINTS/HOUR	949 POINTS/HOUR	449 POINTS/HOUR
MANUAL POINT ENTRY	200 POINTS/HOUR	1147 POINTS/HOUR	947 POINTS/HOUR

Figure 5-2. ACDDS Workstation Throughput

5.2.2.2 Recommended Replacement System for the LIS

The Advanced Cartographic Data Digitizing System (ACDDS) constitutes a recommended system to replace the current Lineal Input System (LIS) presently operating at DMA centers. With its strong, efficient, flexible and adaptable features, the ACDDS can be utilized, for the ever changing requirement within the cartographic community at DMA for several years to come.